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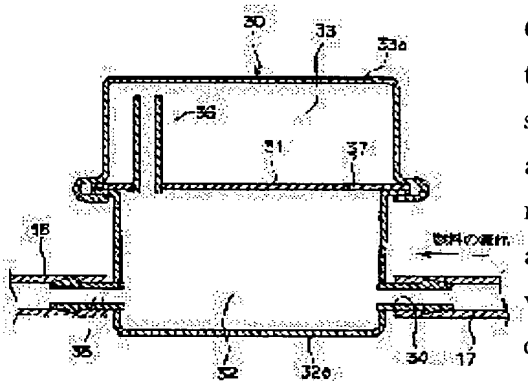
(54) FUEL SUPPLY DEVICE FOR INTERNAL COMBUSTION ENGINE

(57)Abstract:

PURPOSE: To accelerate the liquefaction of vapor while improving the storage capacity of vapor and air.

CONSTITUTION: A vapor strainer 30 is provided on the way of fuel pipelines 17, 18. The interior of the vapor strainer 30 is partitioned into two vertical chambers by a partition wall 31, and the lower chamber is made a main chamber 32, while the upper chamber is made an auxiliary chamber 33. The partition wall 31 is provided with a pipe-like communicating part throttle 36 for communicating the main chamber 32 and the auxiliary chamber 33 with each other. This communicating part throttle 36 is extended to the upper part of the auxiliary chamber 33, and the upper end opening of the communicating part throttle 36 is positioned at the upper part of the auxiliary chamber 33. The partition wall 31 is further provided with small holes 37 formed to return fuel, accumulated in the auxiliary chamber 33, little by little to the main chamber 32. The auxiliary chamber 33 accumulates vapor and air rising from the main chamber 32 through the communicating part throttle 36 and also functions as an air damper for damping pulsating pressure generated at the valve opening/closing time of an injector.



[Claim(s)]
[Claim 1] The fuel supply system of the internal combustion engine characterized by forming at least one free passage section drawing which makes said septum open said two ** for free passage while preparing the main rooms where the passage cross section expands the fuel sent through a fuel line from a fuel pump in the middle of said fuel line in an internal combustion engine's fuel supply system distributed to the injector of each cylinder in a delivery pipe and preparing the accessory cell in said main room upside through the septum.
[Claim 2] The fuel supply system of the internal combustion engine according to claim 1 characterized by having extended said free passage section drawing in the upper part of said accessory cell, and locating upper bed opening of said free passage section drawing in the upper part of said accessory cell.
[Claim 3] The fuel supply system of the internal combustion engine according to claim 2 characterized by forming the stoma which returns a fuel collected on said accessory cell to said septum small quantity every at said main rooms.
[Claim 4] The fuel supply system of the internal combustion engine according to claim 1 to 3 characterized by holding the filter material which filters a fuel in said main rooms.
[Claim 5] The fuel supply system of the internal combustion engine according to claim 1 to 4 characterized by having return loess piping composition in which said fuel line serves as termination in said delivery pipe.

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the fuel supply system of the internal combustion engine which improved the reservoir structure of vapor (evaporative gas) or air generated in the fuel supplied to a delivery pipe.
[0002]
[Description of the Prior Art] As shown in JP,6-129325,A in recent years, in order to eliminate the air mixed in the delivery pipe according to the vapor generated within the delivery pipe (fuel distribution room) which distributes a fuel to each injector, or a certain cause While arranging the fuel pipe (accessory cell) which branched from the upstream fuel line from the delivery pipe above a delivery pipe Open this fuel pipe and a delivery pipe for free passage with free passage section drawing, and at least one of each connectors which distribute a fuel to each injector from a delivery pipe is extended in the upper part in a delivery pipe. Upper bed opening of this connector is made to counter with soffit opening of the above-mentioned free passage section drawing, and there are some which discharged the vapor which collected in the upper part in a delivery pipe or a fuel pipe, and air according to the sink force of an injector.
[0003]
[Problem(s) to be Solved by the Invention] However, the tooth space of a delivery pipe in which a fuel pipe (accessory cell) is installed since it is arranged to the narrow tooth space near the engine is also narrow, and it cannot be set as the magnitude of which the volume of a fuel pipe is required. For this reason, the reservoir capacity of vapor air is insufficient and the inside of a fuel pipe tends to fill with vapor or air. And since this fuel pipe is arranged near the engine, the temperature of a fuel pipe may tend to become an elevated temperature by engine heat dissipation, heat dissipation and temperature lowering of the vapor in this fuel pipe may be barred, and liquefaction (condensation) of vapor may be barred.
[0004] This invention is made in consideration of such a situation, therefore improving the reservoir capacity of vapor air, it can promote liquefaction of vapor and the object is in offering the fuel supply system of the internal combustion engine which is stabilized and can perform fuel supply to an injector.
[0005]
[Means for Solving the Problem] In order to attain the above-mentioned object, the fuel supply system of the internal combustion engine of claim 1 of this invention In what distributed the fuel sent through a fuel line from a fuel pump to the injector of each cylinder in the delivery pipe While preparing the main rooms which the passage cross section expands in the middle of said fuel

line and preparing an accessory cell in said main room upside through a septum, it considers as the configuration which formed at least one free passage section drawing which makes said septum open said two ** for free passage.

[0006] In this case, it is desirable to extend said free passage section drawing in the upper part of said accessory cell, and to locate upper bed opening of said free passage section drawing in the upper part of said accessory cell like claim 2. Furthermore, it is desirable to form the stoma which returns a fuel collected on said accessory cell to said septum small quantity every like claim 3 at said main rooms.

[0007] Moreover, it is good also as a configuration which held the filter material which filters a fuel in said main rooms like claim 4. Also in which [these] configuration, it is desirable to consider as the return loess piping configuration in which said fuel line serves as termination in said delivery pipe like claim 5.

[0008]

[Function] As the fuel breathed out from the fuel pump flows to a delivery pipe through a fuel line, it passes along the main interior of a room which the passage cross section expands by the configuration of claim 1 mentioned above. Since this main room is open for free passage with the upper accessory cell through free passage section drawing, the vapor and air which were contained in the fuel of the main interior of a room pass free passage section drawing by buoyancy, flow into an upper accessory cell, and are stored there. The main rooms and an accessory cell raise the cooling nature of an accessory cell, carry out temperature lowering of the vapor, and promote liquefaction of vapor while it is possible to arrange in the location distant from the delivery pipe to some extent and becoming possible to give a leeway in an arrangement location in tooth space, and to expand the volume (that is, volume of the reservoir room of vapor air) of an accessory cell, since it is prepared in the middle of the fuel line.

[0009] By the way, if the pulsating pressure generated within a delivery pipe by fuel-injection actuation (valve-opening close) of an injector spreads to a fuel pump side, without decreasing the inside of the fuel in a fuel line, a fuel line will be vibrated and the noise will be generated. However, with the configuration of claim 1, since vapor and air are accumulated in the accessory cell of the main room upside prepared in the middle of the fuel line, an accessory cell functions as a kind of air damper, and a pulsating pressure declines according to the air damper effectiveness. Furthermore, the pressure fluctuation by the pulsating pressure goes back and forth through free passage section drawing between the main rooms and an accessory cell, the vapor, the air, and the fuel in an accessory cell are stirred, and the vapor to the inside of a fuel and the penetration of air are promoted.

[0010] On the other hand, in claim 2, free passage section drawing is extended in the upper part of an accessory cell, and upper bed opening of free passage section drawing is located in the upper part of an accessory cell. It comes to carry out updrift linearly through free passage section drawing by this to the field of vapor air where the vapor and air of the main interior of a room are piling up in the upper part of an accessory cell, and is carried out smoothly, without receiving the viscous drag of the fuel with which the updrift of the vapor air from the main rooms to an accessory cell has collected on the accessory cell.

[0011] Furthermore, in claim 3, a fuel collected on the accessory cell is returned to the main rooms small quantity every from the stoma formed in the septum. It prevents the inside of an accessory cell filling with vapor or air by this, and neither the vapor into an accessory cell nor the inflow of air is barred. Moreover, in claim 4, the dust in a fuel etc. is filtered with the filter material held in the main rooms, and it removes. Therefore, the main rooms function also as a fuel filter.

[0012] Moreover, in claim 5, the fuel line has return loess piping composition which serves as termination in a delivery pipe. With this configuration, since return piping which returns some fuels in a fuel tank from a delivery pipe is unnecessary, a fuel line configuration is very easy and turns into a configuration suitable for the demand of low-cost-izing and space-saving-izing. By this invention, although there is also work which returns the vapor which collects in a

delivery pipe, and air to a fuel tank side, since the conventional return piping can eliminate the vapor and air in a fuel by the main rooms and accessory cell which were prepared into the fuel line, even if it does not prepare return piping, it is stabilized and can perform fuel supply to an injector.

[0013]

[Example] Hereafter, the 1st example of this invention is explained based on drawing 1 thru/or drawing 6 . First, based on drawing 1 , the outline configuration of the whole fuel-supply system is explained. A fuel pump 13 is formed in the fuel tank 12 carried in the back of a car 11, and the suction opening of this fuel pump 13 is equipped with the filter 14. The pressure regulating valve 15 for keeping fuel pressure constant is formed in the delivery side of a fuel pump 13, the excessive fuel of the fuels breathed out from the fuel pump 13 returns, and it is returned in a fuel tank 12 through tubing 16. It returns with these pressure regulating valves 15, and tubing 16 is formed in the fuel tank 12 with the fuel pump 13.

[0014] The fuel breathed out through a pressure regulating valve 15 from the above-mentioned fuel pump 13 is sent to the delivery pipe 19 through fuel lines 17 and 18. In the middle of fuel lines 17 and 18, the fuel filter 20 which removes the dust in a fuel etc., and the vapor strainer 30 mentioned later are formed. The delivery pipe 19 is horizontally installed near the inlet manifold (not shown) of the engine 22 in the engine room 21 established in the anterior part of a car 11 (refer to drawing 3), and distributes the fuel in the delivery pipe 19 to the injector 23 formed for every cylinder of an engine 22 (internal combustion engine). In this case, return piping which fuel lines 17 and 18 have return loess piping composition used as termination in the delivery pipe 19, therefore returns a fuel to a fuel tank 12 from the delivery pipe 19 is not prepared.

[0015] The vapor strainer 30 with which a fuel is sent from a fuel line 17 is arranged at about 26 bridge wall in an engine room 21 so that it may keep away from an engine 22. The fuel line 18 which connects this vapor strainer 30 and the delivery pipe 19 is constituted by the heat-resistant rubber hose, and in order that the vapor and air which collect in the delivery pipe 19 may make it easy to flow to the vapor strainer 30, this fuel line 18 is piped from the delivery pipe 19 side so that it may become high gradually to the vapor strainer 30 side.

[0016] As shown in drawing 2 , housing of the vapor strainer 30 closes two housing 32a and 33a by the flange, and is constituted, and the septum 31 is put between the flanges of both the housing 32a and 33a. By this, the interior of the vapor strainer 30 is divided into two upper and lower sides by the septum 31, lower ** turns into the main rooms 32, and upper ** is an accessory cell 33. The fuel inlet-port section 34 and the fuel outlet section 35 are formed in the both-sides surface part of housing 32a of the main rooms 32, the fuel line 17 connected with a fuel pump 13 is connected to the fuel inlet-port section 34, and the fuel line 18 connected with the delivery pipe 19 is connected to the fuel outlet section 35. The passage cross-sectional area is expanded as compared with fuel lines 17 and 18, and the main rooms 32 supply a fuel to the delivery pipe 19 side, being in arrears with a fuel in the main rooms 32.

[0017] Moreover, the free passage section drawing 36 of the shape of one pipe which makes a septum 31 open the main rooms 32 and an accessory cell 33 for free passage is formed, this free passage section drawing 36 is extended in the upper part of an accessory cell 33, and upper bed opening of the free passage section drawing 36 is located in the upper part of an accessory cell 33. The location of the free passage section drawing 36 has become near the fuel outlet section 35 so that it may mention later, and it may be easy to move the vapor which moved into the main rooms 32 through the fuel line 18 from the delivery pipe 19 to an accessory cell 33 through the free passage section drawing 36. Furthermore, the stoma 37 which returns a fuel collected on the accessory cell 33 to the main rooms 32 small quantity every is formed in the septum 31.

[0018] Next, an operation of the vapor strainer 30 is explained using drawing 4 thru/or drawing 6 . Here, drawing 4 and drawing 5 show the flow of the fuel at the time of engine start up of the beginning in a works production line with a slash, and parts other than a slash turn into a part of air. Drawing 4 (a) shows the condition before

engine start up in the works production line. In this condition, a fuel is not yet supplied to fuel lines 17 and 18, the vapor strainer 30, and the delivery pipe 19, but air is in close. If a fuel pump 13 is turned on, it energizes to a starter (not shown) and cranking of the engine 22 is carried out in this condition, as a slash shows to drawing 4 (b), drawing 5 (a), and (b), the fuel pumped up from the fuel tank 12 with the fuel pump 13 will be supplied to the delivery pipe 19 through the main room 32 -> fuel line 18 of the pressure regulating valve 15 -> fuel line 17 -> vapor strainer 30. Since the fuel has not reached the delivery pipe 19 as shown in drawing 4 (b), air is injected from an injector 23, but if cranking is carried out for a while, as soon shown in drawing 5 (a), a fuel will reach the delivery pipe 19 and a fuel will come to be injected from an injector 23 at the beginning of cranking initiation. If it will be in such a condition, start up of an engine 22 will be completed, an engine 22 will come to carry out an independence revolution, but as shown in drawing 5 (a), air piles up in the accessory cell 33 of the vapor strainer 30 for the time being.

[0019] If the pulsating pressure generated within the delivery pipe 19 by fuel-injection actuation (valve-opening close) of an injector 23 will spread the inside of the fuel in a fuel line 18 if operation of an engine 22 is continued for a while also after that, and it reaches in the main rooms 32 of the vapor strainer 30 Pressure fluctuation arises between the main rooms 32 and an accessory cell 33, as shown in drawing 5 (b), while some fuels in the main rooms 32 are pushed up in an accessory cell 33 through the free passage section drawing 36, air and a fuel are stirred within an accessory cell 33, and the penetration of the air to the inside of a fuel is promoted. Thus, it is returned to the main rooms 32 small quantity every from the stoma 37 of a septum 31, air is discharged at an early stage from a fuel-supply system, and the fuel with which air melted becomes possible [shortening the start-up time amount in a works production line].

[0020] Moreover, the vapor and air by which it was contained in the fuel which passes through the main rooms 32 at the time of operation pass the free passage section drawing 36 by buoyancy, flow into an accessory cell 33, and are usually stored there. An accessory cell 33 functions as a kind of air damper, by this, as the air damper effectiveness shows to drawing 3 , the pulsating pressure at the time of valve-opening close [of an injector 23] declines, and the noise by the pulsating pressure falls.

[0021] By the way, if an engine 22 is suspended immediately after heavy load transit (a climb, high-speed transit), the temperature of an engine 22 becomes an elevated temperature, and by the heat dissipation, the fuel temperature in an injector 23 or the delivery pipe 19 will rise to vapor generating temperature, and will generate vapor in a fuel. Since specific gravity is smaller than a fuel (liquid), this vapor surfaces and piles up in the upper part in the delivery pipe 19, as shown in drawing 6 (a). If an engine 22 is put into operation in this condition (elevated-temperature restart), in case the fuel in the delivery pipe 19 will move, as shown in drawing 6 (b), vapor falls out into a fuel line 18 by buoyancy, comes out, it moves into the main rooms 32 of the vapor strainer 30, and vapor moves into an accessory cell 33 through the free passage section drawing 36 eventually.

[0022] In this case, since the vapor strainer 30 is arranged near the bridge wall 26 of an engine room 21 and it keeps away from the engine 22, the heat dissipation which the vapor strainer 30 receives from an engine 22 decreases, and the temperature in the accessory cell 33 of the vapor strainer 30 becomes quite lower than the inside of the delivery pipe 19. For this reason, heat dissipation and temperature lowering of vapor are promoted within an accessory cell 33, liquefaction of vapor is promoted, and vapor liquefies comparatively conjointly with the stirring effectiveness by the pulsating pressure mentioned above for a short time.

[0023] Since the vapor strainer 30 is formed in the middle of fuel lines 17 and 18 as mentioned above, While it is possible to arrange in the location distant from the delivery pipe 19 to some extent and becoming possible to give a leeway in an arrangement location in tooth space, and to expand the volume (that is, volume of the reservoir room of vapor air) of an accessory cell 33 The cooling nature of an accessory cell

33 is raised and it also becomes possible to promote the liquefaction by heat dissipation and temperature lowering of vapor. Thereby, also in the time of elevated-temperature restart, it prevents the inside of the delivery pipe 19 filling with vapor, it is carried out by stabilizing the fuel supply to an injector 23, and the startability and idle rotational stability at the time of elevated-temperature restart can be raised.

[0024] Moreover, since the free passage section drawing 36 is extended in the upper part of an accessory cell 33 and upper bed opening of the free passage section drawing 36 is located in the upper part of an accessory cell 33 in the above-mentioned example It comes to carry out updrift linearly through the free passage section drawing 36 to the field of vapor air where the vapor and air in the main rooms 32 are piling up in the upper part of an accessory cell 33. It is carried out smoothly, without receiving the viscous drag of the fuel with which the updrift of the vapor air from the main rooms 32 to an accessory cell 33 has collected on the accessory cell 33, and the uptake nature of vapor air improves.

[0025] Furthermore, in the above-mentioned example, since a fuel collected on the accessory cell 33 is returned to the main rooms 32 small quantity every from the stoma 37 formed in the septum 31, it prevents the inside of an accessory cell 33 filling with vapor or air, neither the vapor into an accessory cell 33 nor the inflow of air is barred, and the uptake nature of vapor or air is always maintained good.

[0026] Moreover, since fuel lines 17 and 18 have return loess piping composition which serves as termination in the delivery pipe 19, a fuel line configuration is very easy and the demand of low-cost-izing and space-saving-izing is also filled with the above-mentioned example.

[0027] On the other hand, drawing 7 is the 2nd example of this invention, in this 2nd example, it contains a filter material 38 in the main rooms 32, enables it to filter the dust in a fuel with this filter material 38, and is omitting the fuel filter 20 prepared into the fuel line 17 in the 1st example. The configuration of those other than this is the same as the 1st example.

[0028] In this 2nd example, since the main rooms 32 can be operated also as a fuel filter, the conventional fuel filter 20 becomes unnecessary and much more components mark cutback and low cost-ization of it are attained.

[0029] Although one free passage section drawing 36 was formed in the septum 31, you may make it prepare two or more in each example explained above. Similarly, the stoma 37 formed in a septum 31 is not limited to one piece, either, but may be formed two or more pieces.

[0030] Moreover, although the vapor strainer 30 has been arranged near the bridge wall 26 of an engine room 21 in the 1st example, it cannot be overemphasized that you may arrange to the exterior of an engine room 21, of course in short that what is necessary is just to arrange in the location (that is, location with little heat dissipation received from an engine 22) which is distant from an engine 22 to some extent even if it was in the engine room 21.

[0031] Furthermore, although it returned with the pressure regulating valve 15 and tubing 16 is formed in the fuel tank 12 in the 1st example, it returns with a pressure regulating valve 15, tubing 16 is excluded, a fuel-pressure sensor detects the fuel pressure in a fuel line 18, feedback control of the applied voltage to the motor of a fuel pump 13 is carried out according to the detection value, and it may fixed-be made toize fuel pressure.

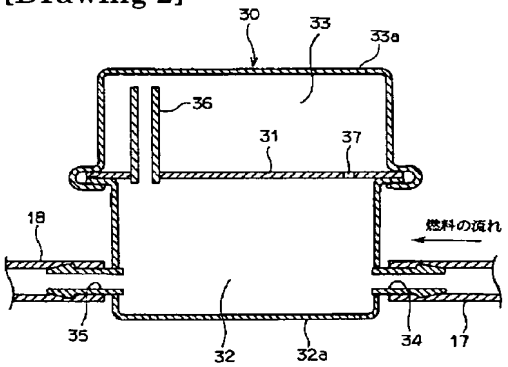
[0032]

[Effect of the Invention] Since according to the configuration of claim 1 of this invention the main rooms which the passage cross-sectional area expands are prepared in the middle of a fuel line and vapor and air were accumulated in this main room and the accessory cell which is open for free passage through free passage section drawing so that clearly from the above explanation Being able to arrange a means (accessory cell) to accumulate vapor and air, in the location distant from the engine which is generous in tooth space, and improving the reservoir capacity of vapor air Cooling nature can be raised, liquefaction of vapor can be promoted, while being stabilized and being able to perform fuel supply to an injector, a pulsating pressure can be attenuated according to the air damper effectiveness of

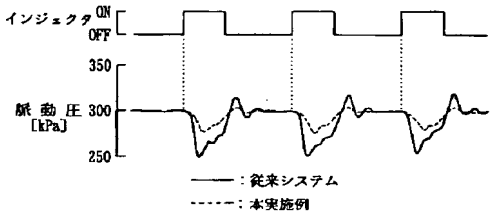
an accessory cell, and the demand of the reduction in the noise can also be filled.
[0033] Moreover, in claim 2, since upper bed opening of free passage section drawing is located in the upper part of an accessory cell, updrift of the vapor air from the main rooms to an accessory cell comes to be performed smoothly, without receiving the viscous drag of the fuel which has collected in the accessory cell, and can raise the uptake nature of vapor air.
[0034] Furthermore, in claim 3, since a fuel collected on the accessory cell can be returned to the main rooms small quantity every from the stoma formed in the septum, it prevents the inside of an accessory cell filling with vapor or air, and it can always maintain the uptake nature of vapor or air good.
[0035] Moreover, in claim 4, since the filter material was contained to the main interior of a room, the main rooms can be operated also as a fuel filter, the fuel filter of dedication becomes unnecessary, and much more components mark cutback and low cost-ization are attained.
[0036] Moreover, in claim 5, since the fuel line has return loess piping composition which serves as termination in a delivery pipe, a fuel line configuration can be simplified.

[Brief Description of the Drawings]
[Drawing 1] The outline block diagram of the whole fuel-supply system in which the 1st example of this invention is shown
[Drawing 2] Drawing of longitudinal section of a vapor strainer
[Drawing 3] Drawing explaining the damping effect of the pulsating pressure generated at the time of valve-opening close [of an injector]
[Drawing 4] Drawing explaining the flow of the fuel at the time of engine start up of the beginning in a works production line (the 1)
[Drawing 5] Drawing explaining the flow of the fuel at the time of engine start up of the beginning in a works production line (the 2)
[Drawing 6] Drawing explaining the behavior of the vapor at the time of elevated-temperature restart
[Drawing 7] Drawing of longitudinal section of the vapor strainer of the 2nd example of this invention
[Description of Notations]
11 -- cars and 12 -- a fuel tank, 13 -- fuel pump, 15 -- filter, and 16 -- return tubing, 17, 18 -- fuel line, 19 -- delivery pipe, and 20 -- a fuel filter, 21 -- engine room, 22 -- engine (internal combustion engine), and 23 -- an injector, 26 -- bridge wall, 30 -- vapor strainer, and 31 -- a septum, 32 -- Lord room, 33 -- accessory cell, and 36 -- free passage section drawing, 37 -- stoma, and 38 -- filter material.

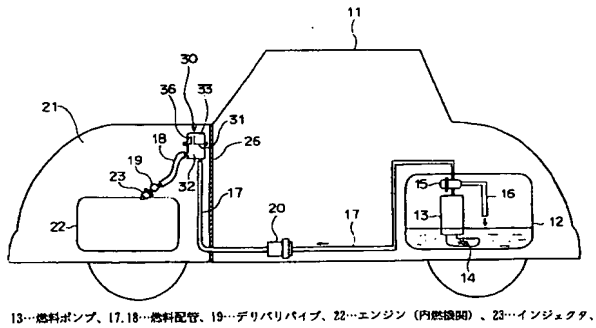
[Drawing 2]



[Drawing 3]

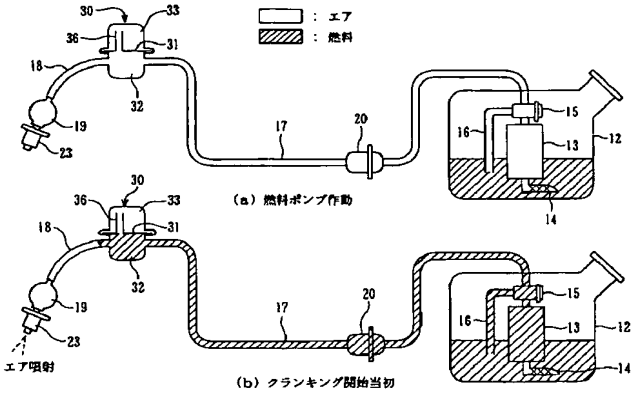


[Drawing 1]

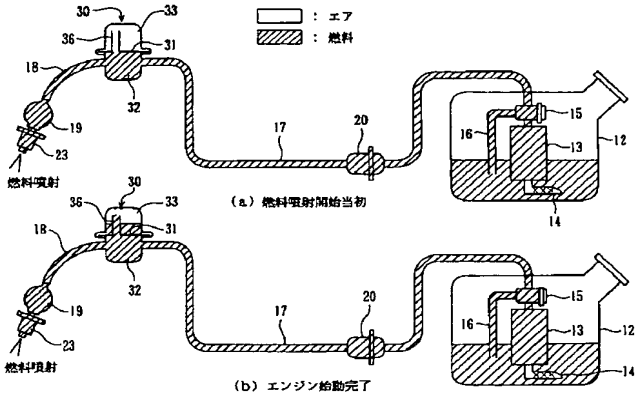


13…燃料ポンプ、17.18…燃料配管、19…デリバリパイプ、22…エンジン（内燃機関）、23…インジェクタ、30…ベーパストレーナ、31…隔壁、32…主室、33…副室、36…通過部絞り

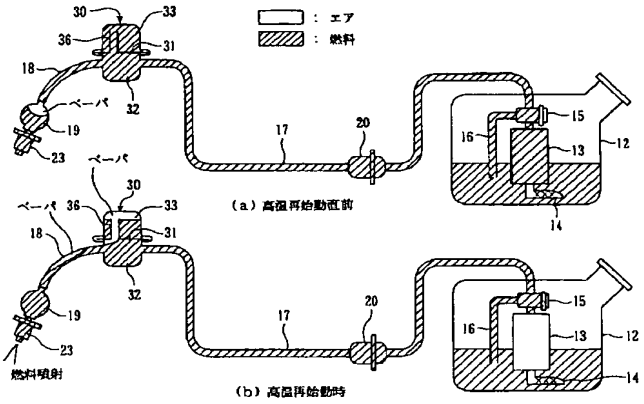
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Drawing 7]